

QUALITY OF SERVICE FINDINGS FOR MOBILE VOICE TELEPHONY AND DATA SERVICES IN UGANDA

1. INTRODUCTION

Uganda Communications Commission (the Commission) is tasked by the Uganda Communications Act 2013 to, among others, promote and safeguard the interests of consumers and operators as regards the quality of communications services and equipment.

In the period from 11th – 22nd November 2023, the Commission conducted measurements to assess the Quality of Service (QoS) received by users/consumers of mobile voice telephony and data services in the areas of Kampala, Mukono and Entebbe from Airtel Uganda Limited (Airtel), MTN Uganda Limited (MTN), Tangerine Limited t/a Lycamobile and Uganda Telecommunications Corporation Limited (UTCL).

2. BACKGROUND

In a mobile network, coverage is a pre-requisite for sending and receiving text messages, making calls, and even using data services/Internet. Coverage refers to the level/strength of the network signal received by the mobile device from the operator's network to which it's connected being at a sufficient level or strong enough to enable communication between the device and the network.

The following information is provided to facilitate the consideration of the findings.

- A. **Blocked call** means a call attempt that fails to achieve a connection to the destination party and therefore does not receive an alerting or ring tone, busy tone, answer signal or announcement.
- B. **Dropped call** means a call terminated by the network before it is ended by either party participating in the call.
- C. **Data Throughput** means the amount of data that gets transferred from one point on the network to another in a given amount of time.
- D. **Latency** means the time taken for a packet of data to travel from a user's device to destination device.
- E. **Packet Loss** depicts the level at which the packets of data sent are dropped along the route and therefore, unable to reach their intended destination.
- F. The Commission standard for QoS is as indicated below.

SN	Parameter	Definition	Target
	Blocked Call Rate (BCR)	Maximum proportion of call attempts on the network blocked.	≤2%
	Dropped Call Rate (DCR)	Maximum proportion of calls on the network dropped.	≤2%
	Call Setup Success Rate (CSSR)	Proportion of call attempts with an indication of call connection (alerting, busy tone, or announcement) within 12 seconds from the instant the user initiates a request.	≥95%

- G. The **speech quality** of voice calls as measured against the International Telecommunications Union's standard - Mean Opinion Score (MOS).

Quality scores	
5	Excellent
4	Good
3	Fair
2	Poor
1	Bad

3. SUMMARY OF THE FINDINGS

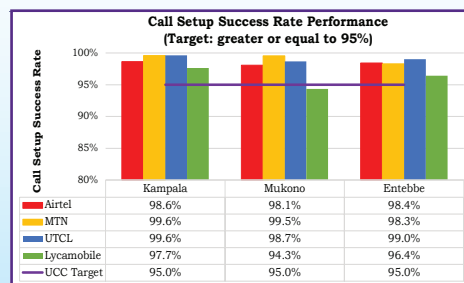


Figure 1: Call Setup Success Rate performance per network per town surveyed.

Aside from hoping that a call initiated succeeds in being connected to the called party, it is desirable that this connection is achieved in the shortest time. Therefore, in the above graph, the higher the call setup success rate, the better the performance of the network.

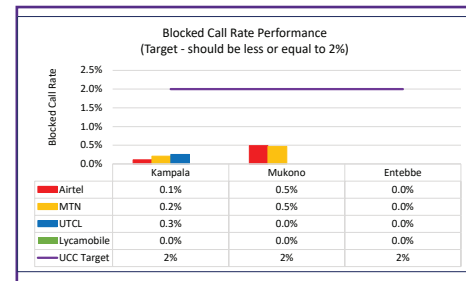


Figure 2: Blocked Call Rate performance per network per town surveyed.

When a call is initiated, the response to the caller should be a ringing tone or an announcement that the other party is busy/unavailable. Otherwise, the call is deemed blocked. The lower the percentage of blocked calls, the better the performance of the network.

Typical causes of failure to establish a call are having weak or no coverage in the specific location, and congestion that occurs when or where there is a higher number of users trying to make a call at the same time in a location than the network capacity available in that area.

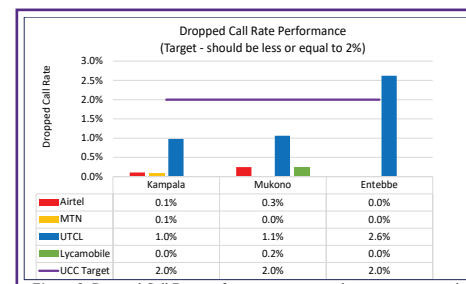


Figure 3: Dropped Call Rate performance per network per town surveyed.

When a connection is made and communication between the parties starts, a disconnection of the call by the network is undesirable. The lower the percentage of dropped calls, therefore, the better the performance of the network.

Common causes of call drop are moving out of range or entering an area (even if momentarily) that doesn't have network coverage; moving into an area having congestion due to insufficiency of network resources with relation to the traffic being handled especially in moving from one location to another; and interference due to another radio signal disrupting or blocking the coverage signal between the network and the phone.

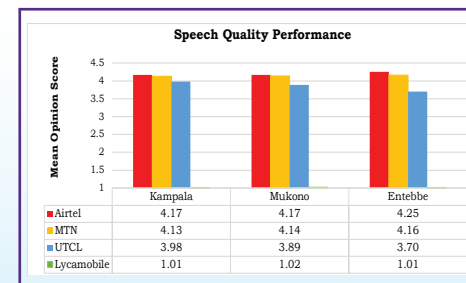


Figure 4: Speech Quality performance per network per town surveyed.

This rates the quality during the call. The higher the score, the better the quality of the call. A score below 3.5 is considered within the telecom industry as inadequate.

Quality of a call may be degraded due to several factors like interference, weak coverage and problems in the equipment or

links that connect the different parts of the network.

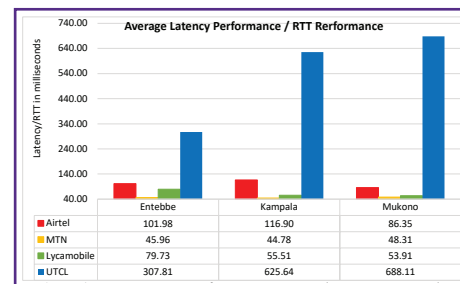


Figure 5: Average Latency performance per network per town surveyed.

This is an indication of the level of delay or how much time it takes transferring data across the network. The lower the value of latency, the faster the data transfer and better the data user experience. This is especially critical to online services/applications needing close to real time experience.

Key cause of latency is distance between requesting and the destination computer responding to the request; how the data is routed; and the equipment and network infrastructure along the path of the data.

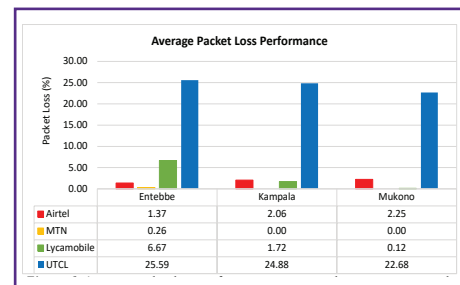


Figure 6: Average packet loss performance per network per town surveyed.

Packet loss is when some segments of data do not reach the intended destination. This can cause network disruption, information loss, amount of data that can go through a connection or a slow service. The lower the value of packet loss, therefore, the better the user or application experience.

The typical causes of packet loss are network congestion, network interference, weak coverage, and inadequate network infrastructure along the communication path.

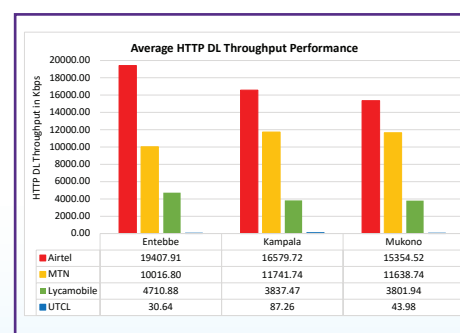


Figure 7: Average HTTP Download Throughput performance per network per town surveyed.

This is the amount of data that can be transferred from the internet within a given timeframe and provides an indication of speeds at which information would be downloaded. The higher the value, the better the performance.

Throughput is affected by the bandwidth (size of pipe), limitations in the network infrastructure, network congestion, interference, coverage, latency, and packet loss.

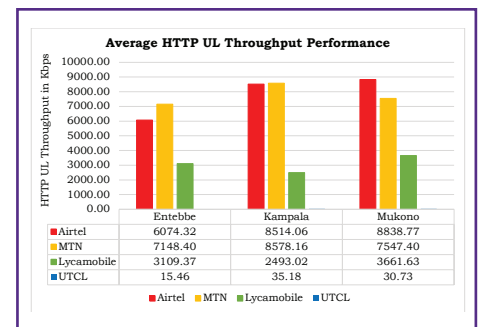


Figure 8: Average HTTP Upload Throughput performance per network per town surveyed.

This provides an indication of speeds at which information is uploaded to the internet. The higher the value, the better.

4. CONCLUSION

It is globally recognized that the quality of service received by consumers may vary with time in the same location or at same time in different locations due to coverage, type of infrastructure, usage traffic and natural factors.

However, from the findings, it is observed that coverage including a number of blackspots (geographical areas with weak signal or no communication coverage) remains a major cause of quality-of-service shortfalls. Black spots are due to:

- (a) physical obstructions e.g. buildings, trees and geographical terrain – valleys and sides of hills,
- (b) placement of tower/mast and the resultant distance relative to user location impacting signal strength,
- (c) dense concrete and metallic building material impacting signal penetration and in turn indoor coverage.

The public is asked to desist from installing signal boosters as these cause interference to the networks. The public is also invited to note that while higher-frequency radiation like x-rays and gamma rays are ionizing in nature because they have energy levels that can disrupt matter at a molecular level and can cause damage to human cells directly, radiation from telecom masts is in the non-ionizing radiation range like visible light, common electrical appliances, radio, and television. After in-depth review of the various scientific literature, the World Health Organization (WHO) concluded that 'despite extensive research, to date, there is no evidence to conclude that exposure to low level electromagnetic fields is harmful to human health.'

To address the quality of service offered, all the operators were given a license obligation to rollout their respective networks to 90% of the geographical coverage of Uganda within 5 years of being licensed. Additionally, in July 2023, the Commission did award additional spectrum to MTN and Airtel with obligations to enhance network coverage and quality of service.

The Commission remains committed to empowering consumers to exercise choice of provider and to ensuring the availability of quality and modern communication services to foster the realisation of the transformation of Uganda into a modern and prosperous country.

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